

PH-1816PCT (Amendments)

5. Content of amendment

(1) In claim 1, the passage "display control means for displaying a mirror image of display on said display panel in every other frame or every other field; and liquid crystal shutter control means for opening and closing said pair of liquid crystal shutter means in synchronism with the operation of said display control means in each frame scan or each field scan such that they do not open simultaneously, wherein said pair of liquid crystal shutter means are opened and closed by said liquid crystal shutter control means such that said mirror image can be observed as the original display on one side of said display panel" is amended to read "display control means for displaying a regular image and a mirror image observed from one side of said display panel on said display panel in each unit scan period based on one field unit or one frame unit; and liquid crystal shutter control means for, while controlling the opening and closing of the liquid crystal shutter means on said one side in synchronism with the regular display by said display control means, said regular display being observed from said one side, such that said regular display can be observed, opening and closing the liquid crystal shutter means on said other side in synchronism with the mirror display by said display control means, said mirror display being observed from said one side, such that the regular display can be observed on said other side, and for controlling the opening and closing of said pair of liquid crystal shutter means such that said pair of shutter means do not open simultaneously".

(2) In claim 2, the passage "the display apparatus according to claim 1" is amended to read "comprising: a display panel whose display can be observed from either side; a pair of liquid crystal shutter means disposed in such a manner as to sandwich said display panel; display control means for

displaying a mirror image of display on said display panel in every other frame or every other field; and liquid crystal shutter control means for opening and closing said pair of liquid crystal shutter means in synchronism with the operation of said display control means in each frame scan or each field scan such that they do not open simultaneously, wherein said pair of liquid crystal shutter means are opened and closed by said liquid crystal shutter control means such that said mirror image can be observed as the original display on one side of said display panel".

(3) In claim 3, the passage "a display panel comprising a plurality of picture elements of which each is composed of a pair of display elements, wherein display can be observed from either side of said display panel; a pair of liquid crystal shutter means disposed in such a manner as to sandwich said display panel; display control means for driving each of said display elements such that a mirror image of display that is being made by a set of display elements consisting of one of said pair of display elements can be displayed by another set of display elements consisting of the other of said pair of display elements; and liquid crystal shutter control means for opening and closing said pair of liquid crystal shutter means in synchronism with the operation of said display control means in each frame scan or each field scan such that they do not open simultaneously, wherein said pair of liquid crystal shutter means are opened and closed by said liquid crystal shutter control means such that said mirror image can be observed as the original display on one side of said display panel" is amended to read "a display panel having a plurality of picture elements, each including a plurality of display elements as a single unit, wherein display can be observed from either side of said display panel; a pair of liquid crystal shutter means disposed in such a manner as to sandwich said display panel, said pair of liquid crystal shutter means being provided for said display panel comprising a plurality of said

picture elements, wherein said pair of liquid crystal shutter means includes liquid crystal shutter means that can open and close in each single display picture element field corresponding to said single picture element; and liquid crystal shutter control means for controlling said liquid crystal shutter means such that a regular image can be observed simultaneously from both surfaces of said display panel, when one liquid crystal shutter corresponding to said single picture element field is put in a transmitting state, by putting the other liquid crystal shutter into a light-blocking state, and, when one liquid crystal shutter corresponding to the other single picture element field is put in the light-blocking state, by putting the other liquid crystal shutter into the transmitting state".

(4) In claim 4, the passage "the display apparatus of claim 3" is amended to read "the display apparatus according to claim 3". Also, the passage "by the one set and the other set of said pair of display elements" is amended to read "by the one set and the other set of said single picture element".

(5) Claims 5 and 6 are deleted.

(6) In claim 7, the passage "wherein said display period in which said first display and said second display" is amended to read "comprising: a display panel having a plurality of picture elements that perform display based on an input signal, said display panel being capable of display on both surfaces, namely a first surface and a second surface, thereof, using a picture element at a selected location; first shutter means and second shutter means disposed on said first surface side and said second surface side, respectively, said first and second shutter means being capable of opening and closing for a single picture element or a plurality of picture elements; and control means comprising display control means for performing display control such that a

first display observed from said first surface side and a second display observed from said second surface side can be viewed as the same display, and shutter control means for controlling the opening and closing of shutters such that the display picture elements on said second surface side are screened by said second shutter means upon said first display, and the display picture elements on said first surface side are screened by said first shutter means upon said second display, wherein said display control means, while switching the display period of said first display and said second display, performs display control such that said first display and said second display have a relationship where they are substantially mirror images of each other upon viewing said first display and said second display from either said first surface side or said second surface side with said shutters open, wherein said display period, in which said first display and said second display". In addition, "according to claim 6" is deleted.

(7) The passage "according to claim 6" in claim 8 is amended to read "according to claim 7".

(8) The passage "according to claim 5" in claim 9 is amended to read "according to claim 7".

(9) The passage "according to any of claims 5 to 9" in claim 10 is amended to read "according to any one of claims 7 to 9".

(10) Claims 11 and 12 are deleted.

(11) The passage "according to claim 7 or 8" in claim 13 is amended to read "according to any one of claims 7 to 10".

(12) The passage "according to any one of claims 11 to 13" in claim 14 is amended to read "according to any one of claims 7 to 10".

(13) In claim 15, the passage "a display panel having a plurality of picture elements that perform display based on an input signal, said display panel being capable of display on both surfaces, namely a first surface and a second surface, thereof, using a picture element at a selected location" is amended to read "a display panel having a plurality of picture elements that perform display based on an input signal, said display panel being capable of display on both surfaces, namely a first surface and a second surface that is opposite to said first surface, thereof, using a picture element at a selected location". Also, the passage "control means comprising ...and shutter control means for controlling the opening and closing of shutters such that the display picture elements on said second surface side are screened by said second shutter means upon said first display, and the display picture elements on said first surface side are screened by said first shutter means upon said second display" is amended to read "control means comprising ... and shutter control means for controlling said shutter means such that a regular image can be observed simultaneously from both surfaces of said display panel, wherein the control of the opening and closing of shutters are performed such that the display picture elements on said second surface side are screened while transmitting the display picture elements on said first surface side by said second shutter means upon said first display, and such that the display picture elements on said first surface side are screened while transmitting the display elements on said second surface side by said first shutter means upon said second display".

(14) In claim 16, the passage "a display panel having a plurality of picture elements, each including at least two, namely a first and a second, display

elements disposed closely to each other, that can provide a display on both surfaces, namely a first display surface and a second display surface, thereof, using a picture element at a selected location" is amended to read "a display panel having a first display surface and a second display surface and capable of display from both surfaces, namely, said first display surface and said second display surface". Also the passage "and shutter control means for controlling the opening and closing of shutters such that the display picture elements on said second display surface side are screened by said second shutter means upon said first display, and the display picture elements on said first display surface side are screened by said first shutter means upon said second display" is amended to read "liquid crystal shutter control means for controlling said liquid crystal shutter means such that a regular image can be observed simultaneously from both surfaces of said display panel by screening the display picture elements on said second display surface side while transmitting the display picture elements on said first display surface side by said second shutter means upon said first display, and by screening the display picture elements on said first display surface side while transmitting the display elements on said second display surface side by said first shutter means upon said second display".

(15) The passage "said display panel and said shutter means" in claim 17 is amended to read "the display control means of said display panel and said shutter". Also, the passage "according to any of claims 5 to 16" is amended to read "according to any one of claims 1 to 4, 7 to 10, and 13 to 16".

(16) The passage "a terminal apparatus comprising the display apparatus according to any one of claims 5 to 17" in claim 18 is amended to read "a terminal apparatus comprising the display apparatus according to any one of claims 1 to 4, 7 to 10, and 13 to 17"

6. List of attached documents

(1) Amended claims (pages 24-30)

CLAIMS

1. A display apparatus comprising:

a display panel whose display can be observed from either side thereof;

a pair of liquid crystal shutter means disposed in such a manner as to sandwich said display panel;

display control means for displaying a mirror image of display on said display panel in every other frame or every other field; and

liquid crystal shutter control means for opening and closing said pair of liquid crystal shutter means in synchronism with the operation of said display control means in each frame scan or each field scan such that they do not open simultaneously, wherein said pair of liquid crystal shutter means are opened and closed by said liquid crystal shutter control means such that said mirror image can be observed as the original display on one side of said display panel.

2. The display apparatus according to claim 1, wherein

said display control means comprises a scan inverting circuit for inverting the direction of a horizontal scan on said display panel in each frame or each field; and

said liquid crystal shutter control means controls the switching of the opening and closing of said pair of liquid crystal shutter means in response to an output from said scan inverting circuit.

3. A display apparatus comprising:

a display panel comprising a plurality of picture elements of which each is composed of a pair of display elements, wherein display can be observed from either side of said display panel;

a pair of liquid crystal shutter means disposed in such a manner as to

sandwich said display panel;

display control means for driving each of said display elements such that a mirror image of display that is being made by a set of display elements consisting of one of said pair of display elements can be displayed by another set of display elements consisting of the other of said pair of display elements; and

liquid crystal shutter control means for opening and closing said pair of liquid crystal shutter means in synchronism with the operation of said display control means in each frame scan or each field scan such that they do not open simultaneously, wherein said pair of liquid crystal shutter means are opened and closed by said liquid crystal shutter control means such that said mirror image can be observed as the original display on one side of said display panel.

4. The display apparatus of claim 3, wherein said display control means causes said mirror image to be displayed alternately in each horizontal scan by the one set and the other set of said pair of display elements.

5. A display apparatus comprising:

a display panel having a plurality of picture elements that perform display based on an input signal, said display panel being capable of display on both surfaces, namely a first surface and a second surface, thereof, using a picture element at a selected location;

first shutter means and second shutter means disposed on said first surface side and said second surface side, respectively, said first and second shutter means being capable of opening and closing for a single picture element or a plurality of picture elements; and

control means comprising display control means for performing display control such that a first display observed from said first surface side

and a second display observed from said second surface side can be viewed as the same display, and shutter control means for controlling the opening and closing of shutters such that the display picture elements on said second surface side are screened by said second shutter means upon said first display, and the display picture elements on said first surface side are screened by said first shutter means upon said second display.

6. The display apparatus according to claim 5, wherein said display control means, while switching the display period of said first display and said second display, performs display control such that said first display and said second display have a relationship where they are substantially mirror images of each other upon viewing said first display or said second display from either said first surface side or said second surface side with said shutters open.

7. The display apparatus according to claim 6, wherein said display period in which said first display and said second display are switched is a unit scan period based on a single field unit or a single frame unit.

8. The display apparatus according to claim 6, wherein said shutter control means controls the opening and closing of shutters in synchronism with the switching of said display period by said display control means.

9. The display apparatus according to claim 5, wherein said control means comprises:

a memory circuit for storing a data signal in each scan unit of said picture element based on said input signal;

a scan inverting circuit for inverting the scan order in each said scan unit;

a signal driving circuit for outputting a data signal to said display panel in order to perform the first display by said scan order and the second display by the inverted scan order based on said inverted scan signal at different times, based on said data signal stored in said memory circuit and said inverted scan signal outputted from said scan inverting circuit;

a signal inverting circuit for inverting the inverted scan signal outputted from said scan inverting circuit; and

a shutter switching circuit for controlling the opening and closing of said first shutter means and said second shutter means based on an output signal from said signal inverting circuit, wherein, upon alternatively displaying either said first display or said second display outputted from said signal driving circuit in each said scan unit, the display surface side on which display has not been selected is screened alternatively by said first or second shutter means.

10. The display apparatus according to any of claims 5 to 9, wherein said first and second shutter means are formed by liquid crystal panels disposed on said first display surface and said second display surface, respectively, in an opposing manner.

11. A display apparatus comprising:

a display panel having a plurality of picture elements, each including at least two, namely a first and a second, display elements disposed closely to each other, which is capable of display from both surfaces, namely a first display surface and a second display surface, thereof, using a picture element at a selected location;

first shutter means and second shutter means disposed on said first display surface side and said second display surface side, respectively, that are capable of opening and closing for each of said display elements; and

control means comprising display control means for performing display control such that a first display observed from said first display surface side and a second display observed from said second display surface side can be viewed as the same display, and shutter control means for controlling the opening and closing of shutters such that the display picture elements on said second display surface side are screened by said second shutter means upon said first display, and the display picture elements on said first display surface side are screened by said first shutter means upon said second display.

12. The display apparatus according to claim 11, wherein said display control means, while switching the display period of said first display and said second display, and performs display control such that said first display and said second display have a relationship where they are substantially mirror images of each other upon viewing said first display and said second display from either said first surface side or said second surface side with said shutters open.

13. The display apparatus according to claim 7 or 8, wherein said control means comprises:

a memory circuit for storing a data signal in each scan unit of said picture element based on said input signal;

a scan driving circuit for providing a scan driving signal to said display panel in the scan order of each said scan unit;

a signal driving circuit for changing the output order of said image signal received from said memory circuit in each scan order, while outputting to said display panel an image signal that is used to perform a first image display by said scan order and a second image display by the inverted scan order based on an inverted scan signal at different times, based on said data

signal stored in said memory circuit and the scan driving signal outputted from said scan driving circuit;

a signal inverting circuit for inverting the inverted scan signal outputted from said scan inverting circuit; and

a shutter switching circuit for controlling the opening and closing of said first shutter means and said second shutter means based on an output signal from said signal inverting circuit, wherein, upon alternatively displaying either said first display or said second display based on said image signal outputted from said signal driving circuit in each said scan unit, the display surface side on which display has not been selected is screened alternatively by said first or second shutter means.

14. The display apparatus according to any one of claims 11 to 13, wherein said first and second shutter means are formed by liquid crystal panels disposed on said first display surface and said second display surface, respectively, in an opposing manner.

15. A display apparatus comprising:

a display panel having a plurality of picture elements that perform display based on an input signal, said display panel being capable of display on both surfaces, namely a first surface and a second surface, thereof, using a picture element at a selected location;

first shutter means and second shutter means disposed on said first surface side and said second surface side, respectively, that are capable of opening and closing for a single picture element or a plurality of picture elements; and

control means comprising display control means for performing display control of a first display observed from said first surface side and a second display, which is different from said first display, observed from said

second surface side, and shutter control means for controlling the opening and closing of shutters such that the display picture elements on said second surface side are screened by said second shutter means upon said first display, and the display picture elements on said first surface side are screened by said first shutter means upon said second display.

16. A display apparatus comprising:

a display panel having a plurality of picture elements, each including at least two, namely a first and a second, display elements disposed closely to each other, that can provide a display on both surfaces, namely a first display surface and a second display surface, thereof, using a picture element at a selected location;

first shutter means and second shutter means disposed on said first surface side and said second surface side, respectively, that are capable of opening and closing for each said display element; and

control means comprising display control means for performing display control of a first display observed from said first display surface side and a second display, which is different from said first display, observed from said second display surface side, and shutter control means for controlling the opening and closing of shutters such that the display picture elements on said second display surface side are screened by said second shutter means upon said first display, and the display picture elements on said first display surface side are screened by said first shutter means upon said second display.

17. The display apparatus according to any of claims 5 to 16, wherein said display panel and said shutter means are controlled by the same circuit.

18. A terminal apparatus comprising the display apparatus according to any

one of claims 5 to 17.